

feet at some points in the north west. High winds caused heavy drifts at many places, though traffic was interfered with but little. Wheat and rye remained well covered and protected during the greater part of the month, as snow melted but slowly under the influence of continued cold weather. Only patches here and there in exposed fields became bare early in the month from the effects of high winds, principally upon hillsides. Grain is reported poorer in the east and south-east sections than elsewhere. In those sections fields were bare during a considerable part of the winter, and damage from the hessian fly was also reported. At the close of February the condition of wheat and rye over the greater portion of the State was apparently fully up to the average.—*L. M. Day.*

*Porto Rico.*—The mean temperature was 74.9°, or 1.9° above normal; the highest was 96°, at Bayamon on the 23d, and the lowest, 52°, at Cayey on the 8th, 13th and 14th, Cidra on the 13th, and Juana Diaz on the 1st. The average precipitation was 1.39, or 0.96 below normal; the greatest monthly amount, 5.70, occurred at Coamo, and the least, 0.09, at Caguas.

The grinding of sugar cane continues and the weather has been very favorable. Cane is maturing nicely, but the grade of the juice is slightly below the average and not as good as was anticipated. Some new cane is being planted, but the ground is rather dry for this work; the crop is needing rain to insure a good stand, otherwise it is doing well. Tobacco cutting is progressing favorably; the crop is small, but the quality is good. Coffee trees are flowering exceptionally well and a good crop is promised, but some plantations are in need of cultivation. Pastures and small crops are needing rain, especially over the western portion of the island, where the drought continues. Small crops have not done as well as they did during the month of January; marketing continues, but the supply is not as plentiful as last month.—*Joseph L. Cline.*

*South Carolina.*—The mean temperature was 43.2°, or 3.1° below normal; the highest was 78°, at Gillisonville on the 18th, and the lowest, 7°, at Temperance on the 23d. The average precipitation was 3.08, or 1.32 below normal; the greatest monthly amount, 5.40, occurred at Georgetown, and the least, 1.28, at Winnsboro.

Snow occurred on the 23d over the entire State; the snowfall was light over the western, and heavy over the southeastern and eastern portions, followed on the 24th and 25th by ground freeze. Preparation of lands for spring planting well advanced.—*J. W. Bauer.*

*South Dakota.*—The mean temperature was 16.4°, or 1.0° above normal; the highest was 71°, at Rosebud on the 28th, and the lowest, 25° below zero, at Pine Ridge on the 9th. The average precipitation was 0.35, or 0.15 below normal; the greatest monthly amount, 1.40 occurred at Oelrichs, and the least, trace, at Bowdle, Canton, and Ipswich.—*S. W. Glenn.*

*Tennessee.*—The mean temperature was 36.7°, or 3.3° below normal; the highest was 75°, at Springdale on the 18th, and the lowest, 5°, at Silverlake on the 25th. The average precipitation was 1.87, or 2.69 below normal; the greatest monthly amount, 3.10, occurred at Iron City, and the least, 0.79, at Knoxville.

The month was rather unfavorable for winter grain crops. Alternate freezing and thawing had bad effect on wheat, which made little or no progress. The very light snowfall did not give sufficient protection, and the prospect at the close of the month was anything but flattering. In a few counties winter wheat was reported in fair condition, but generally it was much below the average for this period. The seeding of oats, plowing and preparation for planting corn, also other farm work, progressed favorably during the month.—*H. C. Bate.*

*Texas.*—The mean temperature was 48.1°, or 3.5° below normal; the highest was 92°, at Fort Ringgold on the 28th, and the lowest, zero, at Mount Blanco on the 12th. The average precipitation was 1.78, or about normal; the greatest monthly amount, 6.06, occurred at Trinity, while none fell at Fort Brown and Sanderson.

Wheat was suffering for rain at the opening of the month, but showers, with 3 to 4 inches of snow in many localities, proved exceptionally favorable to this crop. Good growth has been made and the crop is promising except in a few scattered localities where the precipitation has not yet been sufficient for the needs of the plant. Prepara-

tions for corn planting have been pushed forward with rapidity under auspicious conditions. Planting is well under way over the southern portion of the State, and will be commenced over the central portion soon. The preparation of land for the next cotton crop is receiving attention, and for the season of the year is well advanced. The weather has been exceptionally favorable for plowing. Oat seeding was completed during the month. The crop is generally up to good stands, and is in a promising condition.

*Utah.*—The mean temperature was 31.0°, or 1.9° above normal; the highest was 75°, at St. George on the 28th, and the lowest, 26° below zero, at Lund on the 13th. The average precipitation was 1.90, or 0.74 above normal; the greatest monthly amount, 4.80, occurred at Tropic, and the least, 0.33, at Giles.—*L. H. Murdoch.*

*Virginia.*—The mean temperature was 31.9°, or 5.3° below normal; the highest was 69°, at Buckingham, Bigstone Gap, and Fontella on the 18th, and the lowest, 1°, at Hot Springs on the 1st. The average precipitation was 0.75, or 3.08 below normal, the greatest monthly amount, 2.51, occurred at Callaville, and the least, trace, at Stanardsville.

No severe storms occurred, but the cold, dry weather obtaining was injurious to winter wheat, oats, and clover. The late sown winter wheat especially was much damaged, the root growth being not sufficient to enable it to withstand the bad effects of freezing and thawing.—*Edward A. Evans.*

*Washington.*—The mean temperature was 35.9°, or about normal; the highest was 71°, at Moxee on the 28th, and the lowest, 9° below zero, at Northport on the 5th. The average precipitation was 4.51, or 0.20 above normal; the greatest monthly amount, 16.09, occurred at Monte Cristo, and the least, 0.94, at Port Townsend.

The fore part of the month was unfavorable to winter wheat, on account of heavy frosts, in the absence of snow. The damage was only slight, however. The latter part of the month was mild and wet, and generally favorable for crops.—*G. N. Salisbury.*

*West Virginia.*—The mean temperature was 27.1°, or 3.6° below normal; the highest was 62°, at Magnolia on the 16th and at Green Sulphur Springs on the 18th, and the lowest, 6° below zero, at Lewisburg on the 1st. The average precipitation was 0.86, or 2.52 below normal; the greatest monthly amount, 1.66, occurred at Spencer, and the least, 0.10, at Magnolia.

Dry, cold weather, with high winds and practically no snow protection was unfavorable for late sown wheat; early sown looks fairly well, having made good growth during fall and early winter, and is well rooted with good top; feed scarce, but stock wintering fairly well where protected; practically no farm work done, although farmers are getting ready for spring work.—*E. C. Voss.*

*Wisconsin.*—The mean temperature was 12.0°, or 5.0° below normal; the highest was 42°, at Pepin on the 28th, and the lowest, 26° below zero, at Hayward on the 6th. The average precipitation was 0.81, or 0.45 below normal; the greatest monthly amount, 1.92, occurred at Milwaukee, and the least, 0.25, occurred at Menasha and Spooner.

The month was favorable to winter crops, the abundant snowfall affording ample protection throughout the month.—*W. M. Wilson.*

*Wyoming.*—The mean temperature was 20.1°, or 1.4° above normal; the highest was 68°, at Fort Washakie and Cody on the 28th, and the lowest, 32° below zero, at Bigpiny on the 13th. The average precipitation was 0.80, or 0.03 above normal; the greatest monthly amount, 2.26, occurred at Centennial, and the least, 0.01, at Fort Washakie.—*W. S. Palmer.*

*Cuba.*—The mean temperature was 72.4°; the highest was 94°, at San Cayetano, and the lowest, 45°, at Rosario (Aguacate). The average precipitation was 1.39; the greatest monthly amount, 3.07, occurred at Cienfuegos, and the least, trace, at San Cayetano and Soledad (Guan-tánamo).

The weather was dry and rather cool over Pinar del Rio, Havana, Matanzas, and northwest Santa Clara; seasonal showers and temperature prevailed over remainder of island. Tobacco in Vuelta Abajo suffered severely, yield very short, crop in fair condition elsewhere. Cane grinding, preparation of ground for spring planting, and the cultivation of new canes progressed actively.—*Montrose W. Hayes.*

## SPECIAL CONTRIBUTIONS.

### ICE CAVES AT FLAGSTAFF, ARIZ.

By Mrs. ELIZABETH RENOE, dated Flagstaff, March 6, 1901.

The ice caves 9 miles southeast of Flagstaff are situated at the base of the mountains, and are thought to be of volcanic origin.

The opening is basin shaped, and only large enough to admit a man entering feet foremost, and dropping from ledge to ledge. In some places the drop is about 8 feet, and the

ledge about 4 feet wide. The total depth is about 20 feet. The first chamber is only about 2½ feet high, but gets higher as one proceeds. It extends about 100 yards, where one may stand upright. It is thought that the snow melting on the mountains runs in and becomes frozen with the cold air. At this time of the year it is filled with ice to the entrance, but about July and August only one chamber, the farthest from the entrance, is frozen.

Cart loads of ice were hauled thence the past summer,

taken from the caves with block and tackle. It had to be first lifted from ledge to ledge and then taken out. It is not thought best to make the opening larger as it might interfere with the freezing. A photograph of the inside is not easily taken, and there are none in Flagstaff, though it would be possible to take one by flashlight. A photograph of the outside would convey no idea whatever as it is merely a pile of rocks, and was found by accident.

## OBSERVATIONS AT HONOLULU.

Through the kind cooperation of Mr. Curtis J. Lyons, Meteorologist to the Government Survey, the monthly report of meteorological conditions at Honolulu is now made partly in accordance with the new form, No. 1040, and the arrangement of the columns, therefore, differs from those previously published.

*Meteorological Observations at Honolulu, February, 1901.*

The station is at 21° 18' N., 157° 50' W.  
Hawaiian standard time is 10<sup>h</sup> 30<sup>m</sup> slow of Greenwich time. Honolulu local mean time is 10<sup>h</sup> 31<sup>m</sup> slow of Greenwich.

Pressure is corrected for temperature and reduced to sea level, and the gravity correction, -0.06, has been applied.

The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual. In which case the extremes are given. The scale of wind force is 0 to 12, or Beaufort scale. Two directions of wind, or values of wind force, or amounts of cloudiness, connected by a dash, indicate change from one to the other.

The rainfall for twenty-four hours is measured at 9 a. m. local, or 7.31 p. m., Greenwich time, on the respective dates.

The rain gauge, 8 inches in diameter, is 1 foot above ground. Thermometer, 9 feet above ground. Ground is 43 feet, and the barometer 50 feet above sea level.

Date.	Pressure at sea level.	Temperature.		During twenty-four hours preceding 1 p. m., Greenwich time, or 2.29 a. m., Honolulu time.									Total rainfall at 9 a. m., local time.
				Temperature.		Means.		Wind.		Average cloudiness.	Sea-level pressures.		
		Dry bulb.	Wet bulb.	Maximum.	Minimum.	Dew-point.	Relative humidity.	Prevailing direction.	Force.		Maximum.	Minimum.	
1.....	29.90	65	67	75	61	60.7	77	w-ne.	1-3	8-0	29.93	29.85	0.03
2.....	29.90	59	57	73	61	54.3	64	n-sw.	1-0	0	29.93	29.83	0.00
3.....	29.88	68	64	77	57	60.5	78	s-ne.	1	1-10	29.94	29.84	0.00
4.....	29.66	70	64	78	67	60.7	71	nne.	2-4	10	29.89	29.60	0.32
5.....	29.53	70	67.5	65	65	62.3	80	se-e	5	10-8	29.67	29.52	0.08
6.....	29.51	69	67	76	68	66.7	84	ss-s.	5-4	10	29.59	29.48	0.53
7.....	29.58	63	66.7	75	66	67.3	85	sw-sw.	9-14	9-10	29.57	29.48	1.01
8.....	29.61	67	65.7	75	66	66.3	89	sw-n.	9-11	10-3	29.68	29.56	1.00
9.....	29.66	73	64	72	65	65.7	82	sw-w.	2-10	10-7	29.71	29.63	0.30
10.....	29.62	69	67.5	70	62	62.3	89	sw.	4-2	2-7	29.72	29.62	0.27
11.....	29.66	71	69.7	77	65	68.3	88	sw-w.	3	10-7	29.69	29.60	0.73
12.....	29.74	72	68.5	77	69	67.7	85	sw.	3	5-10	29.73	29.68	0.06
13.....	29.72	71	69.7	70	70	68.3	89	w.	0-1	10	29.82	29.72	2.27
14.....	29.83	61	58.5	72	68	65.7	92	w-n.	1	10	29.85	29.70	0.54
15.....	29.93	65	59	73	60	58.3	80	sw-ne.	1	5-1	29.96	29.81	0.05
16.....	30.02	67	58	74	60	55.3	62	nne.	1-4	4	30.05	29.94	0.01
17.....	30.09	65	58.5	73	65	57.7	68	ne.	3	6	30.11	30.02	0.02
18.....	29.98	56	54	72	64	53.5	60	nne.	4-5	10	30.11	30.02	0.00
19.....	29.99	58	57.3	74	55	55.3	73	sw.	0-1	1-5	30.04	29.99	0.00
20.....	29.80	63	61	77	57	60.3	81	w.	3	4	29.92	29.80	0.00
21.....	29.81	62	58	77	58	62.3	77	wnw.	4	4	29.88	29.75	0.05
22.....	29.91	56	54	73	59	54.7	70	nw.	3-1	4-1	29.95	29.80	0.00
23.....	29.85	68	62.5	73	54	53.5	67	n-s.	1-0	2	29.96	29.84	0.04
24.....	30.03	56	54.5	75	64	58.7	71	ws-w.	2-0	8-0	30.04	29.86	0.01
25.....	30.09	58	57	75	55	56.0	72	sw-n.	1-0	1-3	30.09	30.00	0.00
26.....	29.94	64	62.7	76	66	60.3	70	se-sw.	1-0	1-3	30.04	29.93	0.00
27.....	29.93	64	62.7	78	63	65.0	81	sw.	2-0	1-6	29.99	29.89	0.00
28.....	30.04	67	64	78	64	63.3	76	sw-ne.	1-3	1-8	30.06	29.91	0.00
Sums..													7.96
Means.	29.822	65.0	61.8	75.0	62.7	61.6	76.5		2.2	5.3	29.890	29.792	
Departure..	-1.09					-1.0	+1.6						+2.00

Mean temperature for February, 1901 (6+2+9)+3=68.7; normal is 70.4. Mean pressure for February, 1901 (9+3)+2=29.833; normal is 29.947.

\*This pressure is as recorded at 1 p. m., Greenwich time. †These temperatures are observed at 6 a. m. local, or 4.31 p. m., Greenwich time. ‡These values are the means of (6+9+2+9)+4. §Beaufort scale.

Mean pressure lowest in twenty years. Mean temperature lowest for February with one exception. General electric storms throughout the group from the 4th to 15th probably came from the south-southwest, during which time the barometer fell to the lowest point reached in twenty years. Very heavy rains and snow fell on the mountains.

## MEXICAN CLIMATOLOGICAL DATA.

Through the kind cooperation of Señor Manuel E. Pastrana, Director of the Central Meteorologic-Magnetic Observatory,

the monthly summaries of Mexican data are now communicated in manuscript, in advance of their publication in the Boletín Mensual. An abstract, translated into English measures, is here given, in continuation of the similar tables published in the MONTHLY WEATHER REVIEW since 1896. The barometric means have not been reduced to standard gravity, but this correction will be given at some future date when the pressures are published on our Chart IV.

*Mexican data for February, 1901.*

Stations.	Altitude.	Mean barometer.	Temperature.			Relative humidity.	Precipitation.	Prevailing direction.	
			Max.	Min.	Mean.			Wind.	Cloud.
Chihuahua.....	Feet. 4,660	Inch. 25.30	69.3	33.4	51.4	59	0.16	sw.	w.
Duran o (Seminarío).....	6,243	24.02	84.4	29.3	54.9	41	0.24	sw.	w.
Leon (Guanajuato).....	5,984	24.31	78.8	37.6	58.5	52	0.63	nw.	sw.
Linares (Nuevo Leon).....	1,188	28.75	87.3	35.6	61.5	66	0.34	n.	s.
Mazatlan.....	25	29.98	79.0	60.3	70.3	77	0.88	nw.	w.
Mexico (Obs. Cent.).....	7,473	23.06	72.7	34.2	57.2	48	0.99	n.	.....
Morelia (Seminarío).....	6,401	23.98	74.7	38.5	55.6	58	1.50	n.	w.
Puebla (Col. Cat.).....	7,112	23.39	73.8	41.9	58.8	54	0.87	e.	sw.
Saltillo (Col. S. Juan).....	5,399	24.79	75.2	39.8	55.9	66	0.47	s.	sw.
San Luis Potosí.....	6,202	24.11	75.6	41.0	58.6	61	1.09	sw.	w.
Tampico.....	38							.....	.....
Zapotlan (Seminarío).....	5,078	25.11	81.0	38.5	61.0	53	1.50	sse.	w.

## RELATIVE LENGTH OF WARM AND COLD SEASONS.

By HENRY PENNYWITT, dated February 20, 1901.

Charts XI, XII, and XIII have been prepared with the view of determining approximately the length of the warm and cold seasons in various locations, by comparing the daily normal temperatures in spring and autumn with the annual means as computed from records for twenty-five years or less of 135 Weather Bureau stations between 1872 and 1898.

The dates on which the daily normal temperatures in spring equal the annual mean vary according to locality. In the upward progress the daily normals first overtake the annual in the Northwest, in the region including the greater portion of Texas and portions of Arkansas, Oklahoma, and Kansas, where the dates range from about the 5th to the 10th of April; in the Mississippi Valley the dates range from the 10th to the 15th of April; in the region extending from the east Gulf States northward to the Ohio Valley, including the eastern portions of Wisconsin and Illinois, all of Indiana, the most of Ohio, and portions of Pennsylvania and New York, the dates fall between the 15th and 20th of April; in the greater portion of the upper Lake region and in a strip near the Atlantic coast between the 20th and 25th of April; along the middle Atlantic coast and in the lower Lake region after the 25th of April; in the region including western Colorado, Utah, portions of Nevada, New Mexico and Arizona, and in southern California, they occur much later, as late as the 1st to 10th of May in the region last named.

In the autumn, when the temperatures are declining, the daily normals first coincide with the annual mean in the Ohio Valley and Gulf States and in the southern slope of the Rocky Mountain region, where this occurs before the 20th of October; along the Atlantic coast about the 25th of October; along the Pacific coast it occurs after the 1st of November, the latest date being in the vicinity of San Francisco, Cal., or about the 20th of November.

If the year be divided into two seasons, the warm and the cold season (the warm season including the time when the daily normals are above the annual mean and the cold season when they are below), it is found that in the greater portion of the United States the warm season is longer than the cold, the exceptions being in the southern slope of the Rocky Mountain region and in small areas in the lower Lake region and Middle Atlantic States. The longest warm season is in